

INTRODUCTION

Recovery Unit Designation

The Little Lost River Recovery Unit is one of 22 recovery units designated for bull trout in the Columbia River basin (Figure 1). The Little Lost River basin was designated a bull trout recovery unit because it is naturally isolated: bull trout habitats in the basin have not been directly connected to habitats in other basins for several thousand years. Bull trout in the basin consist of the only population upstream of Shoshone Falls, a major migration barrier on the Snake River near the City of Twin Falls, Idaho. The Little Lost River basin was also identified as a bull trout key watershed in the Idaho Bull Trout Conservation Plan (Batt 1996; Little Lost River Interagency Technical Advisory Team (LLRITAT) 1998).

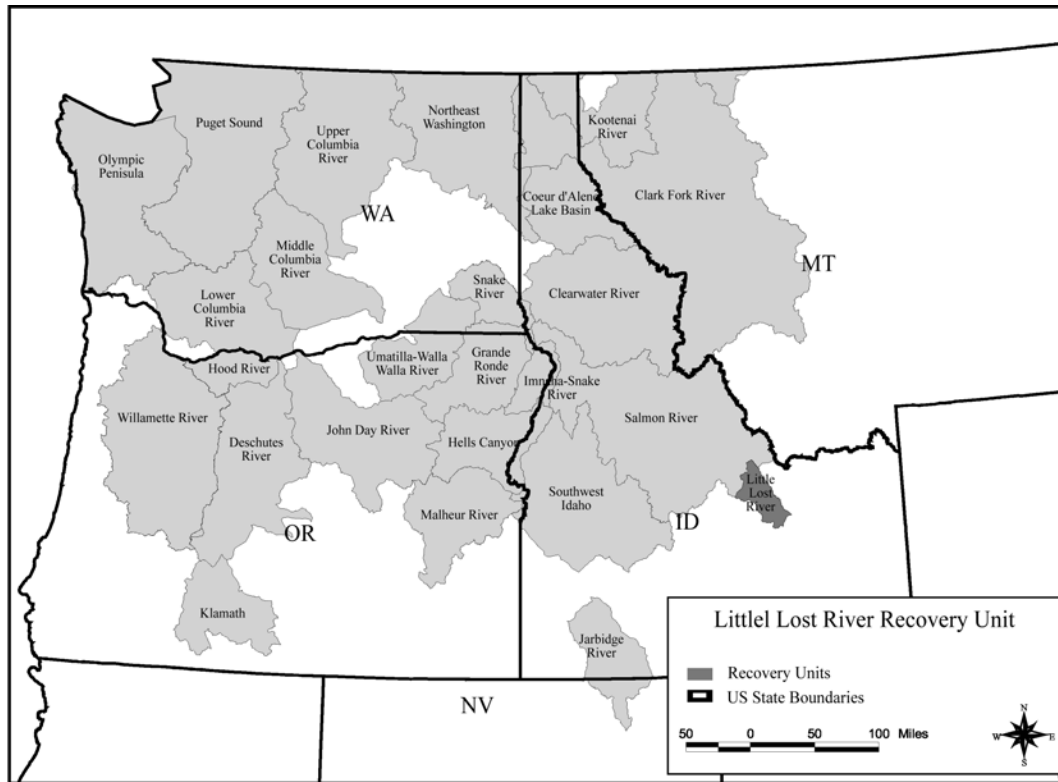
Geographic Description

The Little Lost River lies in a closed basin within the upper Snake River basin. The Little Lost River Recovery Unit encompasses an area of 252,003 hectares (973 square miles) in portions of Butte, Custer, and Lemhi Counties, Idaho (Gamett 1999). Elevations in the basin range from 1,456 meters (4,778 feet) at the Little Lost River Sinks to 3,718 meters (12,201 feet) at the summit of Diamond Peak in the Lemhi Mountains. The river flows southeastward between the Lost River and Lemhi Mountain ranges.

Waters of the Little Lost River Recovery Unit historically flowed into the upper Snake River (*i.e.*, upstream of Shoshone Falls). Because of volcanic eruptions during the Pleistocene epoch, river flow becomes subterranean in the “sinks” area of the Snake River plain. Therefore, the Little Lost River has no surface flow to the Snake River (Gamett 1999). Fish fauna were likely derived from headwater stream transfers with the Salmon River basin (Behnke 1992).

The Little Lost River Recovery Unit encompasses a sparsely populated area (*i.e.*, 1990 census population was 325). Howe, which is located at the downstream end of the Little Lost River valley, is the largest community

Figure 1. Bull trout recovery units in the United States. The Little Lost River Recovery Unit is highlighted.



(population was 20 in 1990). Land ownership in the Little Lost River basin is mixed. The Bureau of Land Management (43 percent) and the U.S. Forest Service (43 percent) manage the majority of lands within the recovery unit (LLRITAT 1998). Privately owned lands make up about 9 percent of the total land in the basin. The Idaho Department of Lands manages small land parcels interspersed within lands administered by the Bureau of Land Management. Lands of the Idaho National Environmental and Engineering Laboratory border the southern portion of the recovery unit.

The climate of the Little Lost River Recovery Unit is cool and dry (Table 1) (Gamett 1999). Annual precipitation varies with elevation, from 250 millimeters (9.8 inches) near Howe to over 1,000 millimeters (39.4 inches) in the Lost River Mountains. The annual mean precipitation near Howe was 239 millimeters (9.4

inches) for 1961 through 1990. Air temperatures at Howe range from –39 degrees Celsius (–38 degrees Fahrenheit) to 39 degrees Celsius (102 degrees Fahrenheit), with an annual mean of 6.3 degrees Celsius (43 degrees Fahrenheit).

Table 1. Mean annual and monthly air temperature and precipitation at Howe, Idaho (1961–1990) (Gamett 1999).

Month	Temperature (degrees Celsius)	Precipitation (centimeters)
January	-8.2	1.7
February	-4.7	1.6
March	0.9	1.4
April	7.2	1.5
May	12.0	2.9
June	16.3	3.4
July	20.3	1.9
August	19.1	2.4
September	13.4	1.7
October	7.2	1.3
November	-0.6	2.0
December	-7.3	2.1
Annual	6.3	23.9

Geology of the Little Lost River Recovery Unit is complex and consists primarily of sedimentary rock, limestone, quartzite, and shale (LLRITAT 1998). The basin has steep slopes, stream channels with many knickpoints, and relatively few meadows. Lands within the recovery unit are subject to rapid erosion and, in some locations, mass wasting (landslides). The basin has relatively high natural erosion rates that can be increased by intense land management activities.

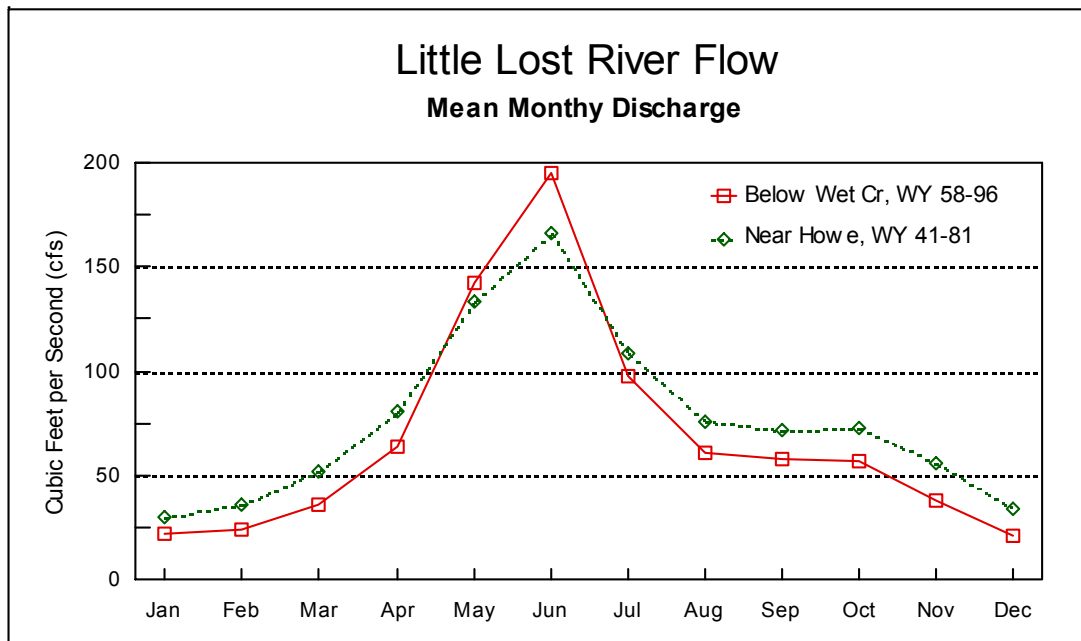
The Little Lost River basin includes 491 kilometers (305 miles) of perennial streams, 40 kilometers (25 miles) of perennial streams and marsh complexes, and 2,453 kilometers (1,525 miles) of intermittent streams (Gamett 1999). Stream flows are highly variable both seasonally and annually, but peak flows typically occur in June and minimum flows occur in December and January (Figure 2). During some portions of the year, flows from several tributaries entering the Little Lost River infiltrate into extensive alluvial fans before reaching the river. Overall, because most reaches of the Little Lost River are located above the water table, water is lost into the underlying alluvial sediments except at certain reaches (*e.g.*, below the confluences of Summit and Badger Creeks).

Fish Species. Eleven species of fish have been documented in the Little Lost River Recovery Unit: bull trout, brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*O. clarki* subspecies), Arctic grayling (*Thymallus arcticus*), shorthead sculpin (*Cottus confusus*), guppy (*Poecilia reticulata*), green swordtail (*Xiphophorus helleri*), amelanic convict cichlid (*Cichlasoma nigrofasciatum*), Mozambique tilapia (*Tilapia mossambica*), and goldfish (*Carassius auratus*) (Gamett 1999). The latter four species are nonnatives that have been found in Barney Hot Springs or Barney Creek. Brown trout (*Salmo trutta*) and mountain whitefish (*Prosopium williamsoni*) have been reported in the basin. Except for bull trout and shorthead sculpin, the remaining species have been introduced into the Little Lost River basin, and whether rainbow trout, cutthroat trout, and mountain whitefish are native to the basin is uncertain. Golden trout (*O. aguabonita*) were introduced but did not establish a population. Hybrids from two pairs of species have also been observed (bull trout x brook trout and cutthroat trout x rainbow trout).

Stocking of hatchery-produced salmonids was discontinued throughout most of the Little Lost River basin in 1985 (Gamett 1999). Catchable-size rainbow are stocked into Big Springs Creek, and cutthroat trout are stocked in four mountain lakes (Swauger Lake #1, Swauger Lake #2, Mill Creek Lake, and Upper Big Creek Lake) every three years. Statewide general trout regulations are applied to stocked waters (*i.e.*, harvest of six trout), whereas the remaining basin is managed under wild trout regulations (*e.g.*, harvest of two cutthroat trout or cutthroat trout hybrids). Ten brook

trout may be harvested from all areas in the basin, and harvest of bull trout has been prohibited throughout the basin since 1994.

Figure 2. Mean monthly discharge of Little Lost River below the confluence of Wet Creek (water years 1958–1996) and near Howe (water years 1941–1981) (LLRITAT 1998).



DISTRIBUTION AND ABUNDANCE

Status of Bull Trout at the Time of Listing

In the final listing rule (63 FR 31647), the U.S. Fish and Wildlife Service identified three bull trout subpopulations in the Little Lost River basin: Wet Creek, Williams Creek, and Little Lost River (USFWS 1998). The Wet Creek subpopulation is isolated by an impassable waterfall, and the Williams Creek subpopulation is isolated by impassable irrigation diversions. The Little Lost River subpopulation was considered to occur in portions of the remainder of the basin. Although subpopulations were an appropriate unit upon which to base the 1998 listing decision, the recovery plan has revised the biological terminology to better reflect the current understanding of bull trout life history and conservation biology theory. Therefore, subpopulation terms will not be used in this chapter.

Current Distribution and Abundance

Bull trout have been collected from the Little Lost River and various tributaries by State and Federal resource agencies (Gamett 1999). Our knowledge of bull trout distribution within the recovery unit is based largely on presence-absence surveys and basinwide surveys that used electrofishing and snorkeling techniques. Surveys conducted from 1992 through 1999 indicate that bull trout have a wide, but fragmented, distribution in the Little Lost River basin (Appendix A). Bull trout occupy approximately 164 kilometers (101.9 miles) of streams and are the only salmonid present in approximately 32 kilometers (19.8 miles) of streams (Gamett 1999). Bull trout occur in the following streams: the upper reach of Badger Creek, upper reach of Big Creek, lower reach of Bunting Canyon Creek, lower reach of Camp Creek, Firebox Creek, Hawley Creek, Iron Creek, Jackson Creek, middle and upper reaches of the mainstem Little Lost River (including Sawmill Creek), Mill Creek, Quigley Creek, Redrock Creek, Smithie Fork, an unnamed tributary to Smithie Fork, Summit Creek, Timber Creek, Squaw Creek (Sawmill Canyon), North Fork Squaw Creek, lower reach of Slide Creek, upper reach of Warm Creek, Wet Creek (except for the middle section), and Williams Creek.

Bull trout were previously observed in some reaches and streams where they were not detected in recent surveys (1992 through 1999). Bull trout were found in the lower reach of the Little Lost River near Howe in 1983 (Corsi *et al.* 1986), which was prior to annual dewatering of this reach beginning in 1985, indicating that bull trout probably occupied all reaches of the river. Bull trout were not found in the reach during 1987 (Corsi and Elle 1989) or more recently (Gamett 1999). Bull trout were reported from Big Springs Creek in 1977 (Gamett 1999), lower Squaw Creek (Wet Creek watershed) in 1987 (Corsi and Elle 1989), and Dry Creek during the 1920's and 1960's (Gamett 1999). However, bull trout were not collected in these streams during surveys conducted in the 1990's (Gamett 1999). Because bull trout may exhibit a patchy distribution within a stream, detecting them may be difficult, even with relatively intensive sampling efforts (see Gamett [1999] for examples).

Abundance of bull trout (expressed as density, or the number of individuals per kilometer of stream) has declined in some areas of the Little Lost River and its tributaries. In the reach of the Little Lost River from the confluence of Summit Creek upstream to the National Forest boundary, bull trout density declined 91 percent between 1984 and 1993 (Table 2) (Gamett 1999). In the reach of the river between the National Forest boundary upstream to the confluence of Smithie Fork, bull trout density declined 62 percent between 1987 and 1995. Bull trout densities were higher in later surveys of both reaches, a finding that suggests that bull trout declines were probably related to low water levels and associated high temperatures due to drought, to degraded habitat conditions downstream of Warm Creek, and to angler harvest.

Bull trout abundance has declined in other tributaries of the Little Lost River basin. According to personal communications with local residents, relatively large bull trout (300 to 500 millimeters [11.8 to 19.7 inches]) were caught by anglers during the 1940's through the 1960's in Big Creek, a tributary in the Wet Creek watershed (Gamett 1999). Bull trout were also reported in 2 of 7 years of creel census data collected during 1969 through 1979 (63 and 16 percent of all species in 1974 and 1977, respectively). In 1978, brook trout were introduced in Big Creek. Gamett (1999) noted that five sites were sampled in Big

Table 2. Estimated densities (individuals per stream kilometer) of rainbow trout, brook trout, bull trout, and all species combined for two reaches of the Little Lost River from surveys conducted in the 1980's and 1990's (Gamett 1999).

Sample date	Rainbow trout	Brook trout	Bull trout	Species combined
Little Lost River—Summit Creek upstream to National Forest boundary				
October 1984	173	27	45	245
July 1985	83	32	61	176
July 1986	123	21	45	189
July 1987	150	52	24	226
August 1993	203	20	4	227
July 1997	208	16	21	245
Little Lost River—National Forest boundary upstream to Smithie Fork Creek				
July 1987	423	90	162	675
August-September 1995	499	33	62	594
July 1997	366	74	87	527

Creek during 1992 through 1997, and bull trout were collected at two sites. At these two sites, 2 and 6 percent of all trout collected were bull trout (2 bull trout and an apparent hybrid at one site; 7 apparent hybrids at the other), whereas 38 and 77 percent of all trout were brook trout. In 1999, no bull trout were collected at two other sites (USFS 1999). Presumed declines of bull trout in Big Creek are probably associated with brook trout interactions, and similar declines are probably occurring in Mill Creek and lower Squaw Creek (Sawmill Canyon). Sampling in Wet Creek during 2001 suggests that adult bull trout have undergone substantial declines in abundance (Table 1 of Appendix B).

Both resident and migratory (fluvial) bull trout exist in the Little Lost River Recovery Unit. Bull trout in the Little Lost River below Iron Creek road are fluvial

and migrate to headwater streams to spawn. The smallest bull trout captured in the Little Lost River downstream of Iron Creek Road (10 sampling sites) was 151 millimeters (5.1 inches) in total length (Gamett 1999). In 1987, Corsi and Elle (1989) found that age 1 and age 2 bull trout in the Little Lost River basin were 99 millimeters (3.4 inches) and 155 millimeters (5.3 inches) long, respectively. Data collected downstream of the National Forest boundary (Corsi *et al.* 1986; Corsi and Elle 1986; Elle *et al* 1987; Corsi and Elle 1989) indicate a lack of small bull trout in the Little Lost River downstream of this point. This lack of young-of-the-year and age 1 bull trout in the this area of the Little Lost River indicates that bull trout are spawning and rearing elsewhere.

The primary spawning areas for fluvial bull trout appear to be tributary streams in Sawmill Canyon. Bull trout over 300 millimeters (11.8 inches) long were observed in many streams of Sawmill Canyon during the spawning period in July, August, and September (Corsi and Elle 1989; Gamett 1999), indicating that these fish may be migratory. If so, fluvial bull trout may be migrating over 30 kilometers (18.6 miles) to spawn, and historically, bull trout may have migrated the length of the Little Lost River, over 80 kilometers (49.7 miles). High densities of young bull trout in Smithie Fork, the Little Lost River upstream of Smithie Fork, and Firebox Creek suggest that these streams are the most important spawning and rearing tributaries for fluvial bull trout. In 1995, bull trout densities (fish greater than 70 millimeters [2.8 inches]) long were as high as 30.3 fish per 100 square meters (2.8 fish per 100 square feet) in Smithie Fork and 20.4 fish per 100 square meters (1.9 fish per 100 square feet) in the Little Lost River upstream of Smithie Fork (Gamett 1999).

Relatively large bull trout have been observed in Wet Creek and in Big Creek, a tributary of Wet Creek, suggesting that these fish were fluvial (Gamett 1999). Bull trout up to 430 millimeters (16.9 inches) long have been recorded by electrofishing and creel surveys in Big Creek. Relatively large fish, up to 635 millimeters (25.0 inches) in length and 3.9 kilograms (8.6 pounds) in weight, that appeared to be bull trout x brook trout hybrids have been collected by electrofishing and angling in and around a beaver pond near the head of Big Creek. In July 1996, snorkelers observed bull trout over 300 millimeters (11.8 inches) long in Wet Creek in the beaver ponds immediately below Hilts Creek. The large size of these fish in relation to the size of

Wet Creek suggests that they were fluvial fish that migrated into these areas to spawn. For both Big Creek and Wet Creek, bull trout were probably migrating from lower Wet Creek and possibly from the Little Lost River. Length frequency data suggest that bull trout in Wet Creek above the falls that are located 0.8 kilometers (0.5 miles) above Hilts Creek are resident fish. The old diversion structure, falls, and cascades at this point are probably a barrier to upstream fish movement.

There is insufficient data to determine whether migratory bull trout occur in Mill Creek, Quigley Creek, Squaw Creek (Sawmill Canyon), Slide Creek, North Fork Squaw Creek, Warm Creek, or Badger Creek (Gamett 1999). Data on length frequency and length at sexual maturity suggest that bull trout in upper Squaw Creek (Sawmill Canyon) are resident fish. It is likely that fluvial bull trout from the Little Lost River historically used all of these streams for spawning and rearing. However, the bull trout currently found in these streams may be only remnants of a former fluvial population that has reverted to residency. In addition, resident fish may be sympatric with fluvial fish in streams such as Smithie Fork (Gamett 1999).

In the past, fluvial bull trout probably migrated into Williams Creek, but bull trout there now are residents (Gamett 1999). Since the late 1800's, Williams Creek has been permanently diverted for irrigation, and flow does not reach the Little Lost River. Therefore, bull trout inhabiting Williams Creek are completely isolated from fish in other portions of the Little Lost River basin.

REASONS FOR DECLINE

Within the Little Lost River Recovery Unit, elevated stream temperatures are probably the most limiting factor for bull trout (LLRITAT 1998). Land management activities, such as water diversions and improper grazing practices, that degrade aquatic and riparian habitats by altering stream flows and riparian vegetation may elicit or exacerbate unsuitable water temperature regimes for bull trout. Other factors that negatively affect bull trout in the Little Lost River Recovery Unit include habitat fragmentation and isolation due to fish passage barriers, interactions with nonnative brook trout, and possibly harvest of fish due to poaching and to misidentification by anglers. The following factors contributing to the decline of bull trout in the coterminous United States are discussed specifically for bull trout in the Little Lost River Recovery Unit.

Dams

Although there are no major storage dams on the Little Lost River, a flood-control structure (*i.e.*, a diversion dam and two infiltration ditches) was constructed 14 kilometers (8.7 miles) north of Howe to prevent flooding caused by ice jams in the channel (Gamett 1999). The flood-control structure was constructed in 1985 with funding from a Resource, Conservation, and Development grant (U.S. Department of Agriculture) and is operated by the Little Lost River Watershed Improvement District. Operation of the structure dewateres the lower 17 kilometers (10.5 miles) of the river during winter. The effects on fishes was estimated to be the loss of 4,200 trout, a loss that was mitigated by fish habitat improvement projects located in the river upstream of the confluence of Summit Creek in 1987. The trenches have screens to prevent fish from entering them, but the screens are typically removed because of clogging by ice and debris. The diversion dam is not screened and uses a recurved slide gate, which is typically closed incrementally to divert water into the trenches during the fall or early winter. Some bull trout were observed in isolated pools below the structure after the diversion gate was completely closed in fall 1999.

In accordance with the Endangered Species Act, the Bureau of Land Management and the U.S. Fish and Wildlife Service conducted formal consultation

on the flood-control project because the project was a major Federal action and because “take” of a listed species was occurring. On March 5, 2002, the U.S. Fish and Wildlife Service issued a biological opinion on the flood-control project (USFWS 2002). Terms and conditions in the biological opinion include conducting a feasibility study by December 2003 to develop an array of alternatives (*e.g.*, screening) to reduce or eliminate the loss of bull trout.

Operation of a hydroelectric project has negatively affected aquatic and riparian habitats in the lower portion of Wet Creek (BLM and USFWS 1998). Water is diverted from Dry Creek through a 20-kilometer (12.4-mile) pipeline to a power plant and is emptied into Wet Creek 4 kilometers (2.5 miles) upstream of the confluence with the Little Lost River. The combined flow from Wet Creek and Dry Creek have caused severe channel degradation for 1.8 kilometers (1.1 miles) downstream from the discharge point of the power plant. Although the hydroelectric project has degraded habitats in Wet Creek, a benefit to bull trout may be the cooling effect from Dry Creek water entering lower Wet Creek.

Forestry Management Practices

About 17 percent of the Little Lost River basin is forested in evergreen or mixed stands (LLRITAT 1998). Timber harvesting in the basin has typically been conducted at relatively small scales and primarily in the upper Sawmill Creek watershed. Although overall road density in the Sawmill Creek watershed is relatively low (0.63 kilometer per square kilometer [1.01 mile per square mile]), there are more roads in areas that have been harvested (IDEQ 1998a), and both roads and timber harvest are likely contributing sediment to streams. For example, recently observed slope failures between Jackson Creek and Slide Creek are associated with logging roads. Also, channel braiding, excessive fine sediments, and channel down-cutting are evident in areas of Timber Creek where streamside timber was harvested over 30 years ago. A relatively small area of the Little Lost River Recovery Unit is forested; however, forestry management practices have been applied in these areas, which include bull trout spawning and rearing habitat.

Two large wildfires have affected habitat conditions in the Sawmill Creek watershed (LLRITAT 1998). Both fires were stand replacing and determined to be human caused. In 1966, the Warm Creek fire burned 2,587 hectares (6,393 acres) of rangeland and forestland in the lower watershed. In 1988, the Little Lost fire burned 2,528 hectares (6,246 acres) in the Smithie Fork watershed in the upper, forested portion of that watershed. The effects of the large, high-intensity fires have affected and will continue to affect conditions of fish habitats for many years. Monitoring conducted by the Bureau of Land Management since 1986 for a riparian restoration project suggests that severe post-fire flooding degraded fish habitat in lower Sawmill Canyon. Lower Sawmill Canyon was heavily aggraded by sedimentation from the “blowout” resulting from increased runoff after the fire coupled with poor riparian conditions from intense grazing (BLM 1997). The abundance of native fishes declined after the debris floods of 1989 (BLM and USFWS 1998; Gamett 1999). The relation among forestry management practices (*e.g.*, fire suppression, road construction), the fires, and fish habitats in the Little Lost River Recovery Unit is uncertain.

Livestock Grazing

Livestock graze on private, State, and Federal lands over much of the Little Lost River Recovery Unit. Within the Sawmill Creek watershed, about 9,187 hectares (22,700 acres) are considered rangeland; this amount of land is about 39 percent of the entire of the watershed (LLRITAT 1998). Monitoring of grazing forage and riparian habitat in the Little Lost River basin has been limited. Approximately 15,770 cumulative animal unit months of cattle graze on State and Federal lands in the watershed according to recent estimates; grazing animals include 9,000 cattle and 10,000 sheep (BLM 1979, 1981).

Overgrazing can negatively affect bull trout habitat because of removal of riparian vegetation and trampling of streambanks. Such conditions can result in increased sedimentation rates, bank instability, and elevated water temperatures. High stream temperatures in the Little Lost River below Warm Creek appear to be a result of poor riparian and stream habitat conditions, poor conditions that can be compounded in drought years by low stream flows. Even though the upper portion of

this reach has experienced substantial regeneration of riparian vegetation because of a pilot riparian restoration project established in 1987 (BLM 1997), heavy grazing along the lower portion has impeded growth of woody riparian plants. The resulting erosion of streambanks has led to an unstable channel and to stream meandering in the reach, changes that have increased width-to-depth ratios and water temperatures and produced an unnaturally wide, shallow channel.

The effects of livestock grazing on aquatic and riparian habitats are prevalent factors affecting bull trout habitat in the Little Lost River Recovery Unit. Livestock grazing has degraded aquatic habitats in portions of Badger, Redrock, Wet, and Williams Creeks and contributed high proportions of fine sediments; such changes are probably negatively affecting spawning success of bull trout (Table 5 of Appendix B). Grazing in Wet Creek and the middle and lower reaches of the Little Lost River has degraded habitats used for rearing by juvenile and immature fish and has altered thermal regimes. Grazing on Federal lands in the Warm Creek, Iron Creek, Timber Creek, Smithie Fork Creek, and the upper Little Lost River watersheds is now conducted according to a grazing plan developed through consultation under the Endangered Species Act.

Agricultural Practices

The primary agricultural activities in the Little Lost River basin are crop production, pasture irrigation, and grazing with associated stock watering. Crop production (hay and grain) is limited to approximately 6 percent of the total basin area (LLRITAT 1998). Crop production also only occurs on private lands that are primarily in the valley near the towns of Howe, Fallert, and Clyde. Generally, crop production has the potential to modify hydrologic systems, accelerate sedimentation, and introduce agricultural chemicals into streams; however, crop production is not thought to directly affect bull trout persistence in the Little Lost River Recovery Unit.

Agricultural practices that rely on water diversions result in reduced stream flows and contribute to elevated stream temperature. The diversion structures also are often fish migration barriers. Diversion of surface water for irrigation dates back to the 1870's and has been supplemented by groundwater pumping since 1948.

Currently, more acreage in the Little Lost River basin is sprinkler irrigated than gravity irrigated (IDEQ 1998a), and sprinkler irrigation has lower potential to negatively affect bull trout. Bull trout may be lost in irrigation ditches, but the severity of fish loss in the basin is not known. Some water diversions divert all or a relatively large portion of the flow in some tributaries, such as diversions in Williams and Badger Creeks, and have isolated the streams from the Little Lost River. Numerous water diversions on the Little Lost River, especially in the lower Little Lost River, have probably increased summer water temperatures and reduced habitat quality for bull trout.

Overall, the Little Lost River has experienced extensive channelization and diversion since the late 1800's. Aerial photographs show that much of the Little Lost River between the National Forest boundary and Summit Creek (*i.e.*, middle Little Lost River) has been channelized (Gamett 1999). Although channelized reaches are no longer maintained and are gradually returning to more natural conditions, the effects of channelization on water temperatures and habitat quality are probably still affecting bull trout.

Transportation Networks

Generally, watersheds with the highest road densities are areas where bull trout no longer exist. Overall road density on timber and grazing lands of the Little Lost River Recovery Unit is lower than that for other areas having a substantial portion of public lands (*i.e.*, for public lands outside of roadless and wilderness areas). Road densities in the Little Lost River basin average approximately 0.63 kilometer per square kilometer (1.01 mile per square mile). Some areas in the Sawmill Creek watershed with higher road densities include Timber, Quigley, and Bear Creeks. Bull trout are generally more abundant in the upper Sawmill Canyon and Smithie Fork roadless areas than in other areas of the recovery unit (see Gamett 1999). Sediment from roads, trails, and grazing may be degrading bull trout spawning and rearing habitat in Badger, Iron, Timber, and Wet Creeks (Table 5 of Appendix B).

Mining

Beginning in the 1890's and continuing to the early 1990's, Sawmill Canyon contained localized mining activities (LLRITAT 1998). Mining activity in the canyon primarily consisted of shaft mines in the eastern portion of the watershed. Recreational mining does not appear to be an issue in the Little Lost River Recovery Unit, and there are currently no active mining claims. Therefore, mining is not likely to be negatively affecting bull trout in the Little Lost River Recovery Unit at this time.

Residential Development and Urbanization

Although the Little Lost River Recovery Unit is sparsely populated, with an estimated population of fewer than 400 residents (LLRITAT 1998), available private lands are often used for vacation homes and seasonal occupancy. Private ponds and stream alterations often accompany the development of recreational properties, posing risks to riparian habitat and fish passage. Such development also encourages the introduction of exotic species (*e.g.*, brown trout) into private ponds and stream reaches. Areas of concern include Wet Creek, Big Creek, Summit Creek, Badger Creek, Squaw Creek (Wet Creek drainage), and the Little Lost River, including the middle reach of Sawmill Canyon. Although no negative effects on bull trout habitat are currently documented, residential development coinciding with generally increasing development potentially threatens important bull trout habitats.

Fisheries Management

Brook trout, rainbow trout, and cutthroat trout were introduced into the Little Lost River basin by at least 1915 (LLRITAT 1998). Although brown trout have not been documented in the basin, they have reportedly been caught in the lower portion of the basin in recent years (Gamett 1999). Brook trout are widely distributed in the basin; however, they are abundant only in a few stream reaches. Brook trout were found in Big Creek, Big Springs Creek, Dry Creek, an unnamed tributary to Meadow Creek, Mill Creek, Squaw Creek (Sawmill Canyon), an unnamed tributary to Squaw Creek (Sawmill Canyon), North Fork Squaw Creek, upper Summit Creek, Uncle Ike

Creek, Wet Creek, and portions of the mainstem Little Lost River (Gamett 1999). Brook trout comprised 25 percent or more of the salmonids captured in upper Big Creek, Dry Creek, the mainstem near Mill Creek, an unnamed tributary to Meadow Creek, Mill Creek, lower Squaw Creek (Sawmill Canyon), an unnamed tributary to Squaw Creek (Sawmill Canyon), the lower reach of North Fork Squaw Creek, and Uncle Ike Creek.

Brook trout distribution within the recovery unit has apparently increased during the last 25 years (Gamett 1999). For example, in the 1970's, brook trout were not collected at sites in the Little Lost River from Howe upstream to within the Sawmill Canyon area. But brook trout are currently found throughout most of the Little Lost River (Corsi *et al.* 1986; Corsi and Elle 1986, Corsi and Elle 1989; Gamett 1999). Brook trout were also introduced into Big Creek in 1978, and made up 19 to 77 percent of the salmonids captured at sites sampled in 1994 and 1996 (Gamett 1999). The upstream distribution of brook trout in Sawmill Canyon appears to have remained the same since 1987, possibly because of water temperature and stream gradient.

Although hybridization between brook trout and bull trout in the Little Lost River basin does not appear widespread, fish appearing to be hybrids have been observed in the recovery unit. Gamett (1999) found apparent hybrids in lower and mid Squaw Creek (Sawmill Canyon drainage), Mill Creek, the Little Lost River near Mill Creek, and the upper reach of Big Creek. These same stream reaches also had very few fish that appeared to be pure bull trout. Genetic tests confirmed that a large fish (635 millimeters [25.0 inches] in length, 3.9 kilograms [8.6 pounds] in weight) captured by hook and line in the Big Creek beaver pond was a hybrid. Surveys conducted by the Bureau of Land Management in 2001 documented a bull trout x brook trout hybrid in lower Wet Creek (P. Koelsch, Bureau of Land Management, pers. comm., 2001).

The introduction of brook trout into Big Creek appears to be associated with the decline of bull trout. Likewise, the apparent extirpation of bull trout from Dry Creek appears linked to the introduction of brook trout. Similar declines appear to be occurring in Mill Creek and Squaw Creek (Sawmill Canyon drainage). If these

trends continue, bull trout may disappear from these streams. Also, an expansion of brook trout into streams such as Smithie Fork Creek or Wet Creek would probably eliminate bull trout.

Since 1987, rainbow trout in Sawmill Canyon have expanded into areas previously occupied by only bull trout. In 1970 and 1987, only bull trout were collected in the Sawmill Canyon drainage above Mill Creek (Corsi and Elle 1989). Specifically, rainbow trout were not collected in the Little Lost River near Moonshine Creek. However, rainbow trout comprised 26 percent and 13 percent of the salmonids captured in this reach in 1995 and 1997, respectively. Likewise, bull trout was the only salmonid captured from lower Timber Creek in 1987 (Corsi and Elle 1989). In 1995 and 1997, rainbow trout comprised 14 percent and 5 percent, respectively, of the salmonids collected in this reach. These data suggest that, between 1987 and 1995, rainbow trout advanced between 1.9 kilometers (1.2 miles) and 6.6 kilometers (4.1 miles) up the Little Lost River and into the lower reaches of Timber Creek.

Cutthroat trout have been introduced throughout the Little Lost River drainage (LLRITAT 1998). The earliest cutthroat trout introduction in the drainage may have been in Dry Creek in 1915. Determining where fish were stocked before 1953 is difficult because introductions before that date were listed only by hatchery or county. State stocking records indicate that on June 1, 1915, 25,000 “natives” (probably cutthroat trout), 10,000 brook trout, and 55,000 rainbow trout were given to E.H. Motts in Mackay for “Dry Creek.” The June 2, 1915, edition of the *Mackay Miner* (a local newspaper based in Mackay) indicates that fish had been planted in Dry Creek. Idaho Department of Fish and Game stocking records indicate that 26,200 cutthroat trout had been introduced into the basin in 1936. By 1947, cutthroat trout were introduced into Big Creek and Wet Creek. Dry Creek received additional plantings of cutthroat trout in 1964. Cutthroat trout have also been introduced into Big Creek Lake #2, Copper Lake, Mill Creek Lake, Shadow Lake #1, Shadow Lake #2, Swauger Lake #1, and Swauger Lake #2. And cutthroat trout may have been introduced into other streams, such as Mill Creek and Squaw Creek.

Competitive and predator–prey relations among bull trout, brook trout, rainbow trout, and cutthroat trout and the effects of those relationships on bull trout in the recovery unit are not known. Declines in bull trout have been associated with introductions of nonnative fish such as brook trout (Rieman and McIntyre 1993). In the Little Lost River, however, the decline in bull trout abundance accompanied by an increase in rainbow trout abundance is probably because of high stream temperatures selecting against bull trout rather than because of direct competition from rainbow trout.

Periodic increased fishing activity during spring and summer holidays probably results in incidental harvest of bull trout, particularly where public access is greatest to prime bull trout habitat. In the past, negative effects of angling may have been a limiting factor for bull trout. Anglers could legally harvest up to 6 bull trout daily. In 1987, bull trout accounted for 53 percent of the fish caught by anglers in Sawmill Creek (Corsi and Elle 1989), and 71 percent of the bull trout that were caught were harvested. In 1994, the Idaho Department of Fish and Game implemented “no harvest” regulations.

In 1994, wild trout regulations were implemented in the majority of the basin (above the confluence of Big Springs Creek). These regulations allow for the harvest of two trout per day in the river and tributaries above Big Springs Creek. High mountain lakes and the drainage below, and including, Big Springs Creek remain under the general trout regulation that allows six trout to be harvested. However, only two cutthroat trout or rainbow trout x cutthroat trout hybrids may be harvested from any stream. The statewide regulation allowing an additional 10 brook trout remains in effect throughout the drainage (Gamett 1999).

Accidental angler harvest may be negatively affecting bull trout. Bull trout and brook trout can be difficult to differentiate, and this difficulty can result in anglers accidentally harvesting bull trout. Intentional violation of the existing “no harvest” regulations may also be occurring. For example, an agency fish survey crew, while electrofishing the upper Sawmill Canyon reach of the Little Lost River after the Fourth of July holiday in 1997, observed several large bull trout heads that were obviously harvest mortalities (Gamett 1999).

Bull trout mortalities due to anglers misidentifying fish, mishandling fish, or not complying with regulations may be negatively affecting bull trout in the Little Lost River Recovery Unit. However, the degree that angling mortality has contributed to the decline of bull trout and continues to affect them in the recovery unit is uncertain. Factors associated with fishing should be evaluated, especially in popular fishing areas (*e.g.*, the entire Little Lost River [upper, middle, and lower portions], Wet Creek, Timber Creek, and Smithie Fork Creek), and actions to reduce any negative effects (*e.g.*, increase bull trout identification programs, and revise regulations) should be implemented where appropriate.

Isolation and Habitat Fragmentation

There are several types of barriers to migration of bull trout (adults and juveniles) in the Little Lost River Recovery Unit. The barriers include culverts, seasonal thermal barriers, water diversion structures (*e.g.*, irrigation diversions and the flood-control structure near Howe), hydropower development on Dry Creek, and natural barriers (LLRITAT 1998). Overall, barriers fragment available habitats for bull trout and isolate fish.

Culverts can be migration barriers, particularly in areas with a high density of roads and numerous stream crossings. Problem culverts typically pose velocity barriers to adult and juvenile fish movement, but perched culverts are often height barriers that either injure fish attempting to negotiate them or entirely prevent fish passage. A culvert on Moonshine Creek, a tributary to the upper Little Lost River, may be preventing bull trout access to potentially suitable but unoccupied habitat upstream in the creek. Culverts on Jackson, Hawley, Timber, and Redrock Creeks and on the upper Little Lost River may be inhibiting passage of juvenile bull trout and should be evaluated and, if necessary, modified (Appendix B).

Natural migration barriers include waterfalls, debris slides, beaver dams, gradients over 6 percent, and infiltration of stream flow into alluvial substrate (LLRITAT 1998). Beaver dams do not appear to be barriers in the Little Lost River Recovery Unit; however, decadent beaver dams in Quigley Creek may be inhibiting fish passage. Falls higher than 1 meter (3.3 feet) occur on Big Creek, Smithie Fork

Creek, an unnamed tributary to Smithie Fork Creek, and Wet Creek. Wet Creek also has a potential gradient barrier, exacerbated by a diversion structure 0.8 kilometer (1.3 miles) above Hilts Creek. Flow from Mill Creek Lake infiltrates through a historic slide, blocking fish passage into the lake. Steep gradient is an apparent barrier on Slide Creek.

Both Badger and Williams Creeks are isolated from the Little Lost River during all or portions of the year due to irrigation diversions, and bull trout are isolated within the streams (Gamett 1999). In Badger Creek, bull trout are restricted to a relatively short reach of the stream and to the lower 300 meters (984 feet) of Bunting Canyon Creek. Debris and possibly a head-cut have created a 1-meter (3.3-foot) waterfall 300 meters up the tributary. The waterfall prevents bull trout access to about 3 kilometers (1.9 miles) of apparently suitable habitat.

Unsuitable water temperatures, which may be due to a combination of natural conditions (*e.g.*, low flow and high water infiltration) and management-induced conditions (*e.g.*, low riparian vegetation due to overgrazing, water diversions), may seasonally isolate bull trout. Temperature data from several years are available for some locations, including the Little Lost River at the National Forest boundary and upstream of Summit Creek. Data were collected from these two sites in 1987, 1988, 1994, 1995, and 1997 (Gamett 1999). Maximum stream temperatures at both stations were consistently above 15 degrees Celsius (59 degrees Fahrenheit) during the summer and often reached above 20 degrees Celsius (68 degrees Fahrenheit). During 1994, a hot, dry year, stream temperatures at the National Forest boundary exceeded 20 degrees Celsius (68 degrees Fahrenheit) for 17 days but did not exceed 25 degrees Celsius (77 degrees Fahrenheit). However, in the Little Lost River above Summit Creek, stream temperatures exceeded 20 degrees Celsius (68 degrees Fahrenheit) for 55 days and exceeded 25 degrees Celsius (77 degrees Fahrenheit) for 10 days. Farther downstream, cooler waters from Wet Creek resulted in lower temperatures. The maximum stream temperature recorded in this stream reach was 27 degrees Celsius (81 degrees Fahrenheit) in July 1994 at the old gauging station, which is 3.2 kilometers (2 miles) upstream of the Summit Creek confluence.

ONGOING RECOVERY UNIT CONSERVATION MEASURES

Several activities that have been implemented and are ongoing will improve bull trout and their habitats in the Little Lost River Recovery Unit. The following discussion provides examples of completed and ongoing conservation activities.

Federal Activities

For all proposed Federal activities in the recovery unit, the Salmon-Challis National Forest and Bureau of Land Management are consulting with the U.S. Fish and Wildlife Service in accordance with section 7 of the Endangered Species Act. During consultations, potential effects of proposed activities on bull trout and their habitats are evaluated, and the activities may be modified to reduce or eliminate negative effects on bull trout. Federal activities often include conservation measures beneficial to bull trout, such as reducing sediment delivery to streams by closing or altering forest roads and grazing practices, providing fish passage by replacing improperly constructed culverts, and conducting fish and habitat surveys (see USFWS 1999, 2002). For example, the Forest Service has closed some roads in upper Sawmill Creek, Wet Creek, and Badger Creek to reduce erosion and sediment delivery to streams. Grazing on Federal lands in the Warm Creek, Iron Creek, Timber Creek, Smithie Fork Creek, and the upper Little Lost River watersheds is now conducted according to a grazing plan developed through consultation under the Endangered Species Act. The grazing plan improves past management practices and is adjusted based on the results of monitoring.

The Natural Resources Conservation Service and the Farm Services Agency administer several programs that provide technical or financial assistance, or both, to private landowners to address natural resource problems. Resource management systems are developed with landowners to address concerns about soil, water, air, plant, and animal resources. Programs available to private landowners include the Conservation Reserve Program (CRP), Environmental Quality Incentives Program (EQIP), Wetland Reserve Program (WRP), and Wildlife Habitat Incentives Program (WHIP). Resource management systems are developed with landowners to identify practices that will reduce soil erosion and sediment delivery to streams, restore riparian and wetland functions and values, reduce water consumption on irrigated

agricultural lands, and reduce nutrient and pesticide pollution in water bodies. Typical practices include riparian forest buffers, fencing, use exclusion, irrigation water management, nutrient and pesticide management, prescribed grazing, and livestock watering facilities.

Under sections 303 and 304 of the Federal Clean Water Act, States or the U.S. Environmental Protection Agency set water quality standards, which combine designated beneficial uses and criteria established to protect uses. States or the Environmental Protection Agency designate water bodies that are failing water quality standards as water quality limited under section 303(d); management plans are then required to be developed for those water bodies. Management plans include total maximum daily loads and implementation plans that define site-specific actions and time lines for meeting water quality goals. Four stream reaches in the Little Lost River Recovery Unit appear on Idaho's 1998 303(d) list: two reaches in the Little Lost River and one each in Sawmill Creek and Wet Creek (IDEQ 1998b). Streams were listed for various reasons (*e.g.*, for flow alteration, sediment, temperature) and include reaches coinciding with the distribution of bull trout. For the Little Lost River drainage, the Idaho Department of Environmental Quality has completed a subbasin assessment (IDEQ 1998a), which was accepted by the U.S. Environmental Protection Agency in 2000. Agencies are currently developing implementation plans to address beneficial uses (Koelsch, pers. comm., 2001).

State of Idaho

The Idaho Department of Fish and Game has implemented ongoing conservation measures to benefit bull trout. Bull trout harvest has been prohibited statewide since 1994. The agency has also conducted creel surveys and surveys to determine the distribution of fishes. With the cooperation of the U.S. Forest Service, the Idaho Department of Fish and Game has initiated education efforts to help the public distinguish between bull trout and brook trout. Efforts involved erecting a kiosk display in Mackay, placing large signs at the National Forest boundary in Sawmill Canyon and at the Timber Creek Campground, placing small signs at key locations throughout the drainage, and distributing pamphlets about bull trout (Gamett 1999). Although citations written for possession of bull trout have decreased

following efforts to provide information to the public, discussions with anglers suggest that many are still not able to identify bull trout

In the past, various agencies have preformed projects benefitting bull trout on private lands. For example, a diversion structure that was constructed on Wet Creek 1.5 kilometers (0.9 mile) upstream from the Little Lost River may have been a complete barrier to upstream fish passage (LLRITAT 1998). The Bureau of Land Management, in cooperation with the Idaho Department of Fish and Game and the U.S. Forest Service, constructed a fish ladder at the structure to provide fish passage. In 1998, Butte County replaced a bridge with a culvert in Wet Creek that the Bureau of Land Management and Idaho Department of Water Resources found to be a fish migration barrier because of excessive water velocities (Koelsch, pers. comm., 2001). The County replaced the culvert according to Bureau of Land Management specifications.